

CLAIMS

We claim:

1. A grinding device, comprising at least one grinding segment and a matrix surrounding at least one of said at least one grinding segment, wherein:

5           at least one of said at least one grinding segments is composed of a superabrasive material, a resin bond material, a refractory non-grinding abrasive grain material, a heat-dissipative melt-phase metal material, and a dry lubricant material; and wherein

10           said matrix is composed of an epoxy resin, a dry lubricant, a porosity filler, and a refractory abrasive grain.

2. The grinding device of claim 1, wherein said superabrasive material of said grinding segment is diamond.

15           3. The grinding device of claim 1, wherein said superabrasive material of said grinding segment is cubic boron nitride.

20           4. The grinding device of claim 1, wherein said superabrasive material of said grinding segment is provided in an amount between 10% and 43.75% (by volume) of the total composition of the grinding segment.

25           5. The grinding device of claim 4, wherein said superabrasive material of said grinding segment is provided in an amount of 12% (by volume) of the total composition of the grinding segment.

6. The grinding device of claim 1, wherein said refractory material of said grinding segment is boron carbide.

30           7. The grinding device of claim 1, wherein said refractory material of said grinding segment is provided in an amount less than 10% (by volume) of the total composition of the grinding segment.

8. The grinding device of claim 7, wherein said refractory material of said grinding segment is provided in an amount of 2.2% of the total composition of the

grinding segment.

9. The grinding device of claim 1, wherein a grain size of the refractory material of said grinding segment is less than or equal to a grain size of superabrasive material.

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10. The grinding device of claim 1, wherein a grain size of the refractory material of said grinding segment is between 220 mesh and 1000 mesh.

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11. The grinding device of claim 1, wherein the melt-phase material of said grinding segment is a copper-tin alloy.

12. The grinding device of claim 11, wherein the melt-phase material of said grinding segment is bronze.

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13. The grinding device of claim 1, wherein the melt-phase material of said grinding segment is provided in an amount between 30% and 68% (by volume) of the total composition of the grinding segment.

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14. The grinding device of claim 13, wherein the melt-phase material of said grinding segment is provided in an amount of 34.3% of the total composition of the grinding segment.

15. The grinding device of claim 1, wherein the dry lubricant of said grinding segment is hexagonal boron nitride.

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16. The grinding device of claim 1, wherein the dry lubricant of said grinding segment is molybdenum disulphide.

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17. The grinding device of claim 1, wherein the dry lubricant of said grinding segment is graphite.

18. The grinding device of claim 1, wherein the dry lubricant of said grinding segment is coke.

19. The grinding device of claim 1, wherein the dry lubricant of said grinding segment is a lithium state.

5 20. The grinding device of claim 1, wherein the dry lubricant of said grinding segment is provided in an amount at least 1% (by volume) of the total composition of the grinding segment.

10 21. The grinding device of claim 20, wherein the dry lubricant of said grinding segment is provided in an amount of 2.2% (by volume) of the total composition of the grinding segment.

22. The grinding device of claim 1, wherein said resin bond material of said grinding segment is a polyimide resin.

15 23. The grinding device of claim 1, wherein said dry lubricant of said matrix is molybdenum disulphide.

20 24. The grinding device of claim 1, wherein said dry lubricant of said matrix is provided in an amount between 1% and 5% (by weight) of the total composition of the matrix.

25 25. The grinding device of claim 24, wherein said dry lubricant of said matrix is provided in an amount of 1.7% (by weight) of the total composition of the matrix.

26. The grinding device of claim 1, wherein said porosity filler of said matrix is a ceramic material shaped into spheroids.

27. The grinding device of claim 26, wherein said porosity filler of said matrix is a 14/40 ceramic bubble material.

30 28. The grinding device of claim 1, wherein said porosity filler of said matrix is provided in an amount between 3% and 15% (by weight) of the total composition of the matrix.

29. The grinding device of claim 28, wherein said porosity filler of said matrix is provided in an amount of 7% (by weight) of the total composition of the matrix.

5 30. The grinding device of claim 1, wherein said refractory material of said matrix is aluminum oxide.

10 31. The grinding device of claim 1, wherein said refractory material of said matrix is silicon carbide.

15 32. The grinding device of claim 1, wherein said refractory material of said matrix is boron carbide.

32. The grinding device of claim 1, wherein said refractory material of said matrix is zirconium carbide.

15 33. The grinding device of claim 1, wherein said refractory material of said matrix is provided in an amount between 10% and 70% (by weight) of the total composition of the matrix.

20 34. The grinding device of claim 33, wherein said refractory material of said matrix is provided in an amount of 56.3% (by weight) of the total composition of the matrix.

25 35. The grinding device of claim 33, wherein a grain size of the refractory material of the matrix is equal to or smaller than a grain size of the superabrasive material of the grinding segment.

36. The grinding device of claim 1, wherein the epoxy resin is a two-part epoxy with reactive dilutant and anti-foam additives.